PXI8501
User's Manual

Beijing ART Technology Development Co., Ltd.

Contents

Contents 2
Chapter 1 Overview 3
Chapter 2 Components Layout Diagram and a Brief Description 5
2.1 The Main Component Layout Diagram 5
2.2 The Function Description for the Main Component 5
2.2.1 Signal Input and Output Connectors 5
Chapter 3 Connection Ways for Each Signal 7
3.1 Analog Signal Connection 7
3.2 Digital Input Connection 7
3.3 Digital Output Connection 8
3.4 External Input and Trigger Signal Connection 8
3.5 Multiple-Instrument Synchronization 8
Chapter 4 The Instruction of the AD Trigger Function 10
4.1 AD Internal Trigger Mode 10
4.2 AD External Trigger Mode 10
4.2.1 Signal ATR Trigger 10
4.2.2 DTR Trigger 11
4.3 PXI Bus Trigger 12
4.3.1 Post-trigger Acquisition 13
4.3.2 Pre-trigger Acquisition 13
4.3.3 Middle-trigger Acquisition 14
4.3.4 Delay-trigger Acquisition 14
Chapter 5 Methods of using AD Internal and External Clock Function 16
5.1 Internal Clock Function of AD 16
5.2 External Clock Function of AD 16
Chapter 6 Notes, Calibration and Warranty Policy 17
6.1 Notes 17
6.2 Auto-calibration 17
6.3 Saving Calibration Constants 17
6.4 Warranty Policy 17
Products Rapid Installation and Self-check 19
Rapid Installation 19
Self-check 19
Delete Wrong Installation 19

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Chapter 1 Overview

In the fields of Real-time Signal Processing, Digital Image Processing and others, high-speed and high-precision data acquisition modules are demanded. ART PXI8501data acquisition module, which brings in advantages of similar products that produced in china and other countries, is convenient for use, high cost and stable performance.

Unpacking Checklist

Check the shipping carton for any damage. If the shipping carton and contents are damaged, notify the local dealer or sales for a replacement. Retain the shipping carton and packing material for inspection by the dealer.
Check for the following items in the package. If there are any missing items, contact your local dealer or sales.

- PXI8501Data Acquisition Board
- ART Disk
  a) user's manual (pdf)
  b) drive
  c) catalog
- Warranty Card

FEATURES

Analog Input

- Converter Type: AD7671
- Input Range: ±10V, ±5V, ±2.5V (can be customized 0~10V, 0~5V)
- 16-bit resolution
- Sampling Rate: 10Hz~800KHz/ch
- Input Channels: 8 synchronous inputs
- Analog Input Mode: differential input
- Data Read Mode: inquire and DMA mode
- Memory Size: 256MB (DDR2)
- The memory of each channel is 32MB
- Memory Signs: full, non-empty and half-full
- Clock Source: PXI bus clock, ,PXI_STAR signal and external clock
- PXI Clock Source: TRIG0, TRIG1, TRIG2, TRIG3, TRIG4, TRIG5, TRIG6, TRIG7
- Trigger Mode: middle trigger, post trigger, pre trigger and delay trigger
- Trigger Source: software, ATR, DTR, Trigger Signal (Multi-card Synchronization)
- Trigger Direction: falling edge, rising edge, falling and rising edge trigger
- Analog Trigger Source (ATR)Input Range: ±10V
- Trigger Level: 0~10V
- Trigger Source DTR Input Range: standard TTL level
- Auto-calibration
- Programmable Gain: 1, 2, 4, 8 times (AD8251, default) or 1, 2, 5, 10 times (AD8250) or 1, 10, 100, 1000 times (AD8253)
- AD Conversion Time: ≤1.25μs
- Analog Input Impedance: 10MΩ

- System Measurement Accuracy: 0.01%
- Non-linear error: ±4LSB(Maximum)
- Operating Temperature Range: 0℃~55℃
- Storage Temperature Range: -20℃~70℃

DI digital input

- Channel No.: 8-channel
- Electric Standard: TTL compatible
- High Voltage: ≧2V
- Low Voltage: ≦0.8V

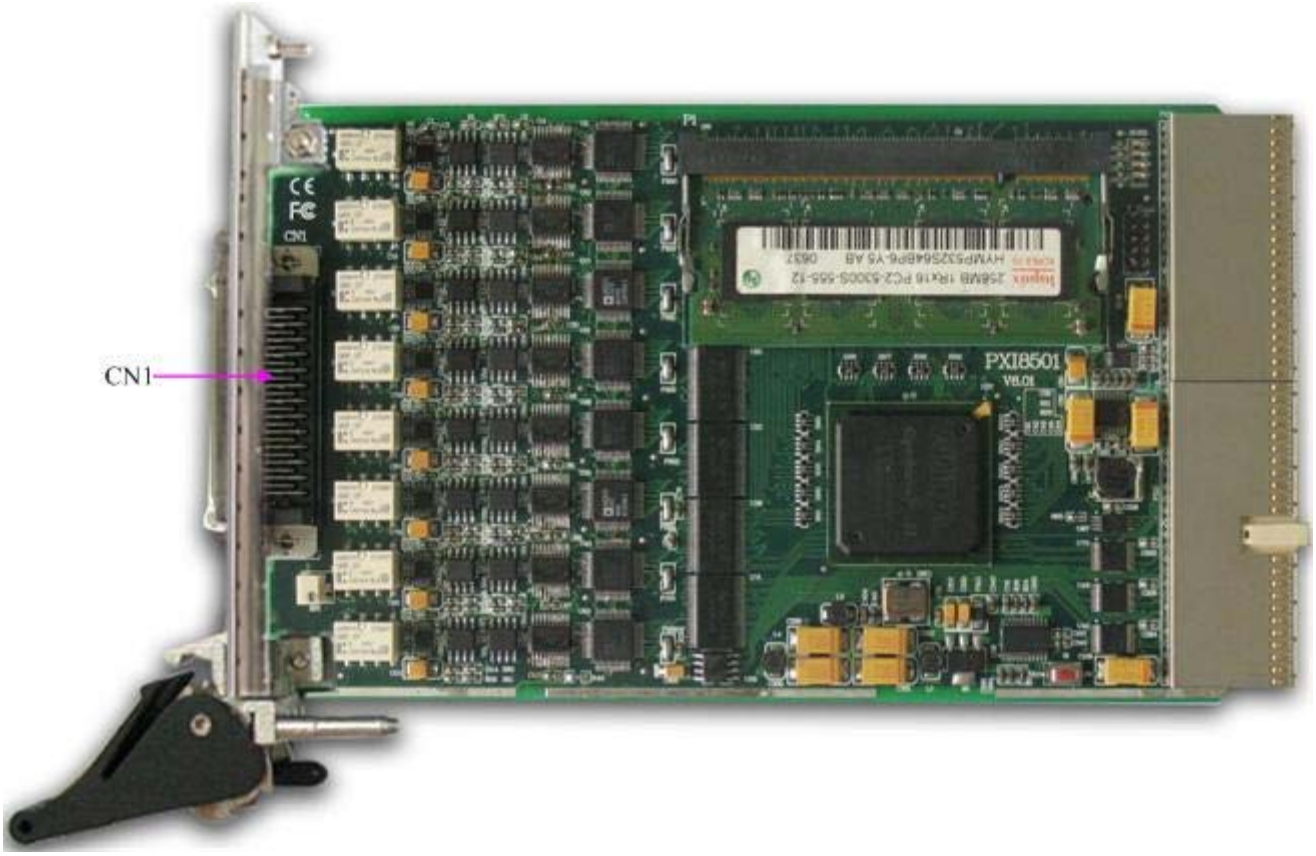
DO digital output

- Channel No.: 8-channel
- Electrical Standard: CMOS compatible
- High Voltage: ≧4.45V
- Low Voltage: ≦0.5V
- Power-on Reset

Board Clock Oscillation: 40MHz

Chapter 2 Components Layout Diagram and a Brief Description

2.1 The Main Component Layout Diagram



2.2 The Function Description for the Main Component

2.2.1 Signal Input and Output Connectors

CN1: signal connector

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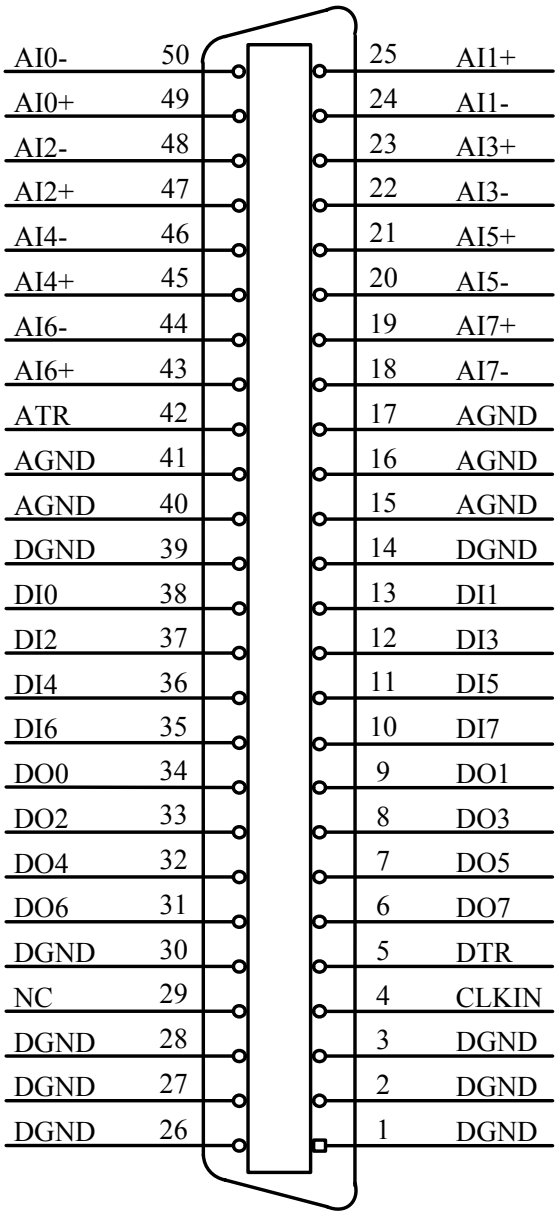


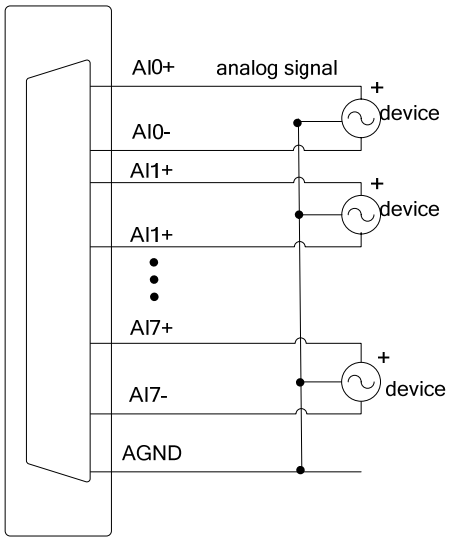
Pin definition

Pin name	Type	Pin function definition
AI0+～AI7+	Input	Analog input (positive)
AI0-～AI7-	Input	Analog input (negative)
AGND	GND	Analog signal ground
DGND	GND	Digital signal ground
CLKIN	Input	Click input
ATR	Input	Analog trigger signal input
DTR	Input	Digital trigger signal input
DI0～DI7	Input	Digital input.
DO0～DO7	Output	Digital output.
NC		NC

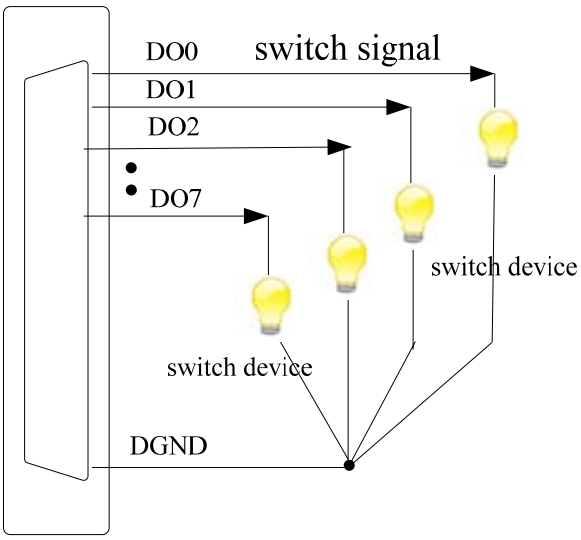
Chapter 3 Connection Ways for Each Signal

3.1 Analog Signal Connection

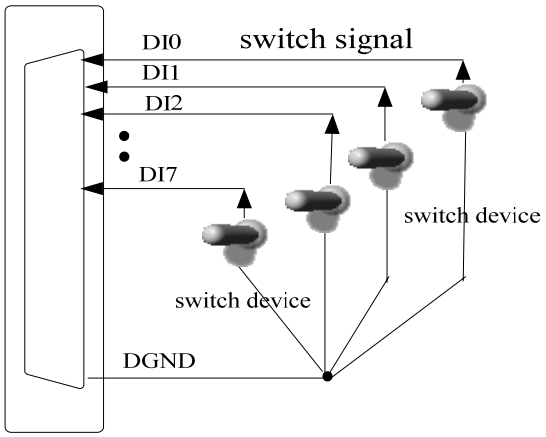
Double-ended input mode, which was also called differential input mode, uses positive and negative channels to input a signal. This mode is mostly used when biggish interference happens and the channel numbers are few.
According to the diagram below, PXI8501oard can be connected as analog voltage double-ended input mode, which can effectively suppress common-mode interference signal to improve the accuracy of acquisition. Positive side of the 8-channel analog input signal is connected to AI0+~AI7+, the negative side of the analog input signal is connected to AI0-~AI7-, equipments in industrial sites share the AGND with PXI8501oard.



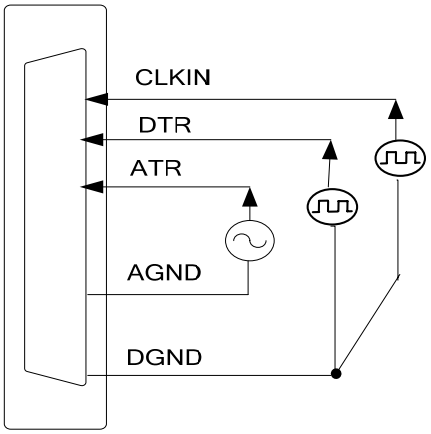
3.2 Digital Input Connection



3.3 Digital Output Connection



3.4 External Input and Trigger Signal Connection



3.5 Multiple-Instrument Synchronization

Three methods can realize the synchronization for the PXI8501, the first method is using the common external trigger, the second one is using the common external clock, and the last one is using the PXI Trigger signal.

When using the common external trigger, please make sure all parameters of different PXI8501 are the same. At first, configure hardware parameters, and use analog or digital signal triggering (ATR or DTR), then connect the signal that will be sampled by PXI8501, input triggering signal from ART pin or DTR pin, then click “Start Sampling” button, at this time, PXI8501 does not sample any signal but waits for external trigger signal. When each module is waiting for external trigger signal, use the common external trigger signal to startup modules, at last, we can realize synchronization data acquisition in this way. See the following figure:

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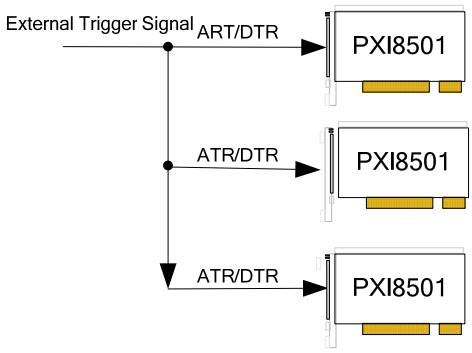
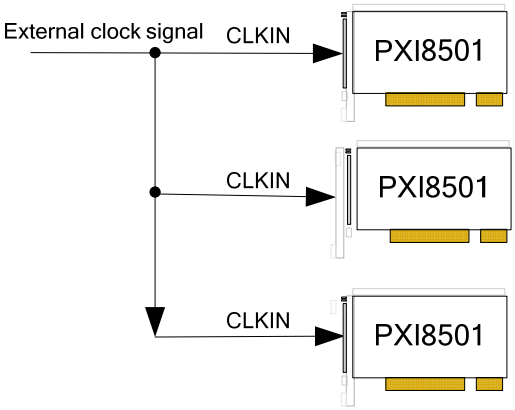
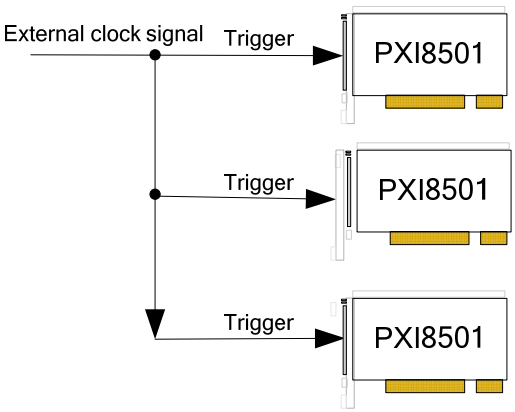


When using the common external clock trigger, please make sure all parameters of different PXI8501 are the same. At first, configure hardware parameters, and use external clock, then connect the signal that will be sampled by PXI8501, , then click “Start Sampling” button, at this time, PXI8501 does not sample any signal, but wait for external clock signal. When each module is waiting for external clock signal, use the common external clock signal to startup modules, at last, we realize synchronization data acquisition in this way. See the following figure:



When using the PXI trigger bus signal, please make sure all parameters of different PXI8501 are the same. At first, configure hardware parameters, and use PXI trigger bus signal, then connect the signal that will be sampled by PXI8501, , then click “Start Sampling” button, start AD conversion, realize synchronization data acquisition. See the following figure:



Chapter 4 The Instruction of the AD Trigger Function

4.1 AD Internal Trigger Mode

When AD is in the initialization, if the AD hardware parameter ADPara.TriggerMode = PXI8501_TRIGMODE_SOFT, we can achieve the internal trigger acquisition. In this function, when calling the StartDeviceProAD function, it will generate AD start pulse, AD immediately access to the conversion process and not wait for the conditions of any other external hardware. It also can be interpreted as the software trigger.

As for the specific process, please see the figure below, the cycle of the AD work pulse is decided by the sampling frequency.

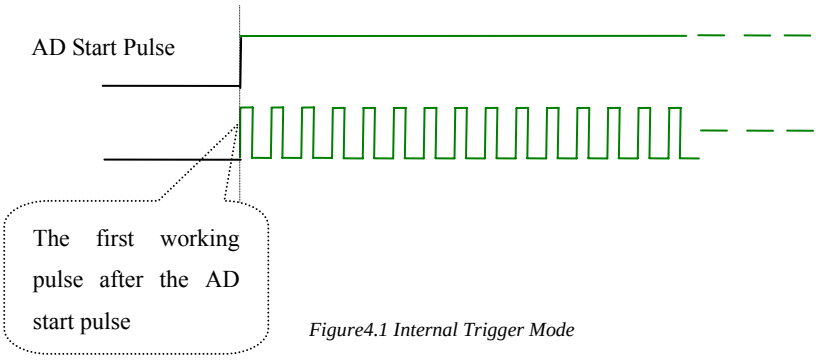


Figure4.1 Internal Trigger Mode

4.2 AD External Trigger Mode

When AD is in the initialization, if the AD hardware parameter ADPara.TriggerMode = PXI8501_TRIGMODE_POST, we can achieve the external trigger acquisition. In this function, when calling the StartDeviceProAD function, AD will not immediately access to the conversion process but wait for the external trigger source signals accord with the condition, then start converting the data. It also can be interpreted as the hardware trigger. Trigger source includes the DTR (Digital Trigger Source) and ATR (Analog Trigger Source).

4.2.1 Signal ATR Trigger

When the trigger signal is the analog signal, using the ATR trigger source. Trigger level needs to be set when using the ATR trigger source, trigger level is -10V~+10V. There are two trigger types: edge trigger and level trigger

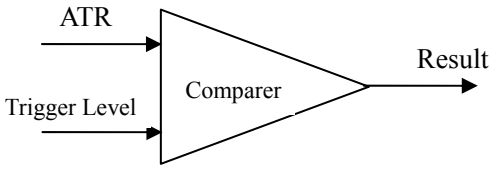


Figure 4.2 Analog compare

When ADPara.TriggerDir = PXI8501_TRIGDIR_NEGATIVE, choose the trigger mode as the falling edge trigger. That is, when the ATR trigger signal is on the falling edge, AD will immediately access to the conversion process, and its follow-up changes have no effect on AD acquisition.

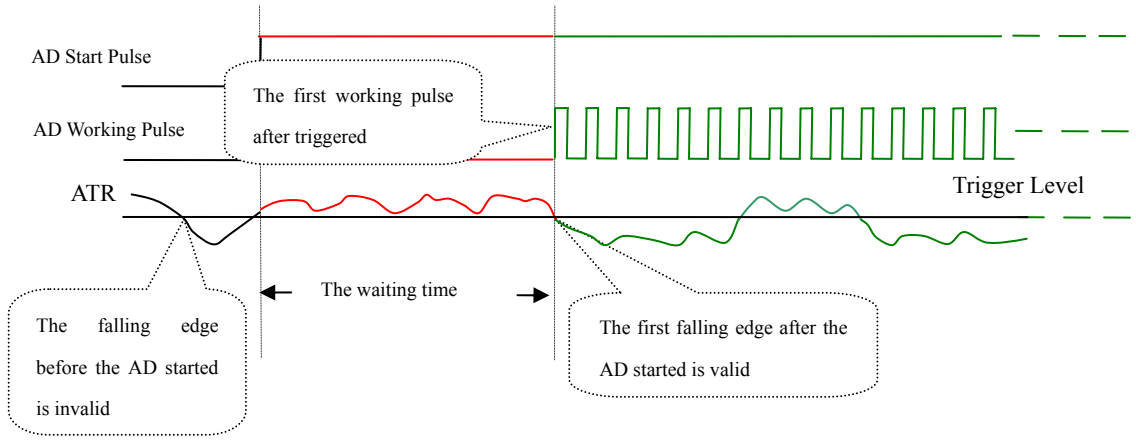

AD Start Pulse
AD Working Pulse
The first working pulse after triggered
ATR
Trigger Level
The waiting time
The falling edge before the AD started is invalid
The first falling edge after the AD started is valid

Figure 4.3 Falling edge Trigger

When ADPara.TriggerDir = PXI8501_TRIGDIR_POSITIVE, choose the trigger mode as rising edge trigger. That is, when the ATR trigger signal is on the rising edge, AD will immediately access to the conversion process, and its follow-up changes have no effect on AD acquisition.

When ADPara.TriggerDir = PXI8501_TRIGDIR_POSIT_NEGAT, choose the trigger mode as rising or falling edge trigger. That is, when the ATR trigger signal is on the rising or falling edge, AD will immediately access to the conversion process, and its follow-up changes have no effect on AD acquisition. This function can be used in the case that the acquisition will occur if the exoteric signal changes.

4.2.2 DTR Trigger

When ADPara.TriggerDir = PXI8501_TRIGDIR_NEGATIVE, choose the trigger mode as the falling edge trigger. That is, when the DTR trigger signal is on the falling edge, AD will immediately access to the conversion process, and its follow-up changes have no effect on AD acquisition.

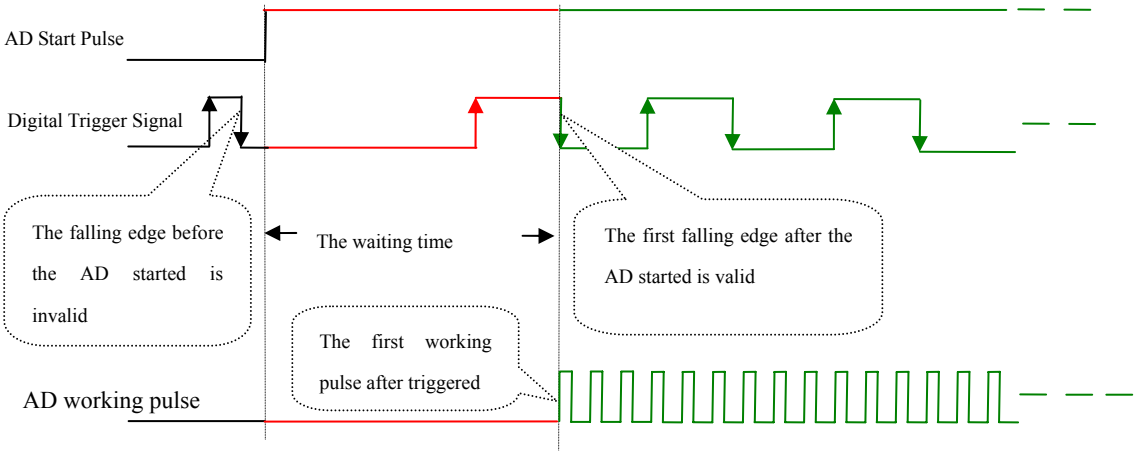

AD Start Pulse
Digital Trigger Signal
The falling edge before the AD started is invalid
The waiting time
The first falling edge after the AD started is valid
The first working pulse after triggered
AD working pulse

Figure 4.4 Falling edge Trigger

When ADPara.TriggerDir = PXI8501_TRIGDIR_POSITIVE, choose the trigger mode as rising edge trigger. That is, when the DTR trigger signal is on the rising edge, AD will immediately access to the conversion process, and its follow-up changes have no effect on AD acquisition.

When ADPara.TriggerDir = PXI8501_TRIGDIR_POSIT_NEGAT, choose the trigger mode as rising or falling edge trigger. That is, when the DTR trigger signal is on the rising or falling edge, AD will immediately access to the conversion process, and its follow-up changes have no effect on AD acquisition. This function can be used in the case that the acquisition will occur if the exoteric signal changes.

4.3 PXI Bus Trigger

Middle trigger, post trigger, pre trigger and delay trigger modes are available to acquire data around the trigger event.

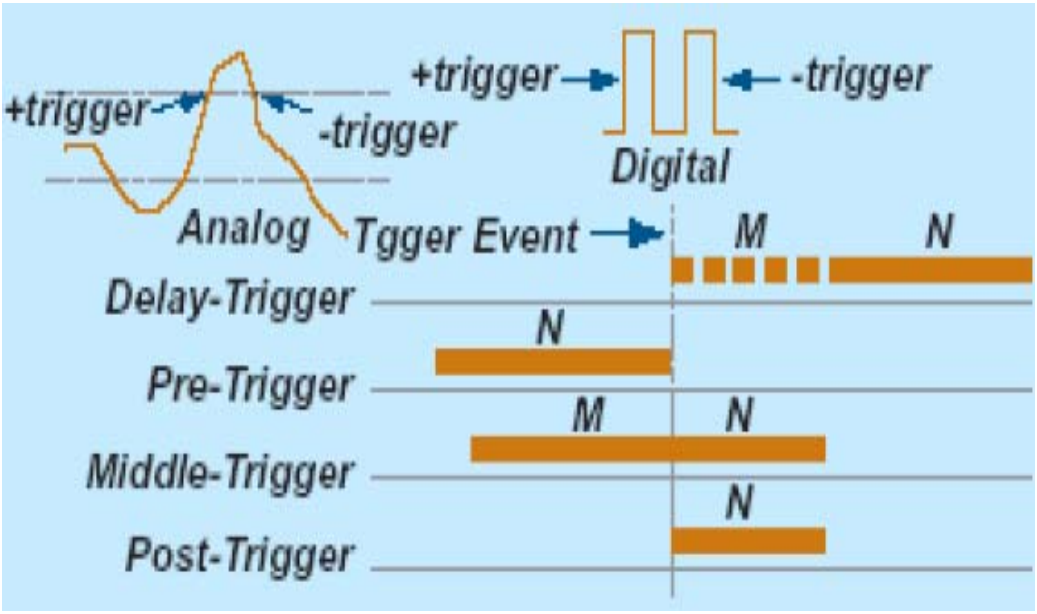


Figure 4.5 PXI Bus Trigger

4.3.1 Post-trigger Acquisition

Use post-trigger acquisition when you want to collect data after the trigger event, as illustrated in figure 4.6.

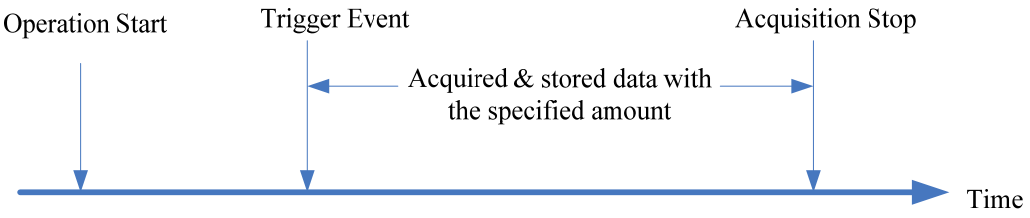


Figure 4.6 Post Trigger

4.3.2 Pre-trigger Acquisition

Use pre-trigger acquisition to collect data before the trigger event. The acquisition starts once specified function calls are executed to begin the pre-trigger operation, and it stops when the trigger event occurs.
If the trigger event occurs after the specified amount of data has been acquired, the system only stores the data before the trigger event with the specified amount, as illustrated in Figure 4.7.

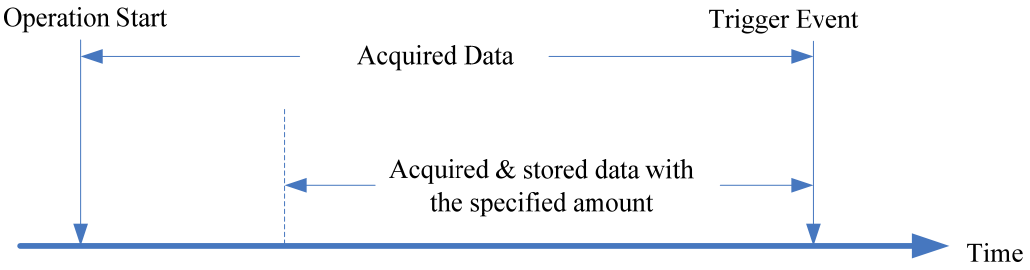


Figure 4.7 Pre Trigger (the trigger event occurs after the specified amount of data has been acquired)

However, if the trigger event occurs before the specified amount of data has been acquired, the system can either stop the acquisition immediately (which implies the stored data will be less then the amount you specified) or ignore the trigger signal until the specified amount of data has been acquired (which assures the user can get the specified amount of data). These can be set by software and are illustrated in Figure 4.8 and Figure 4.9.

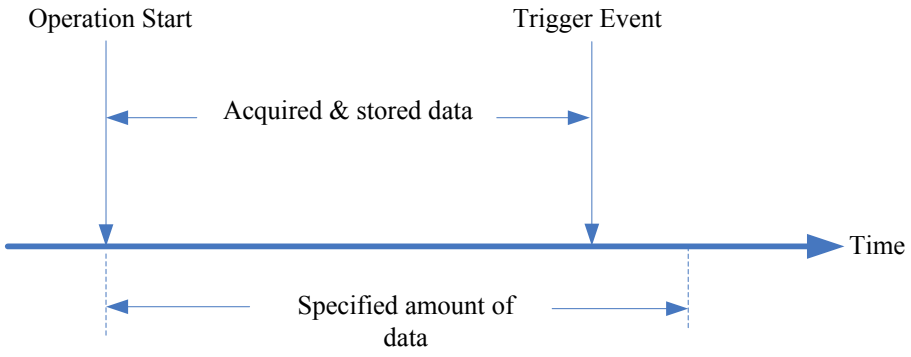


Figure 4.8 Pre Trigger (the trigger signal is accepted anytime after the operation starts)

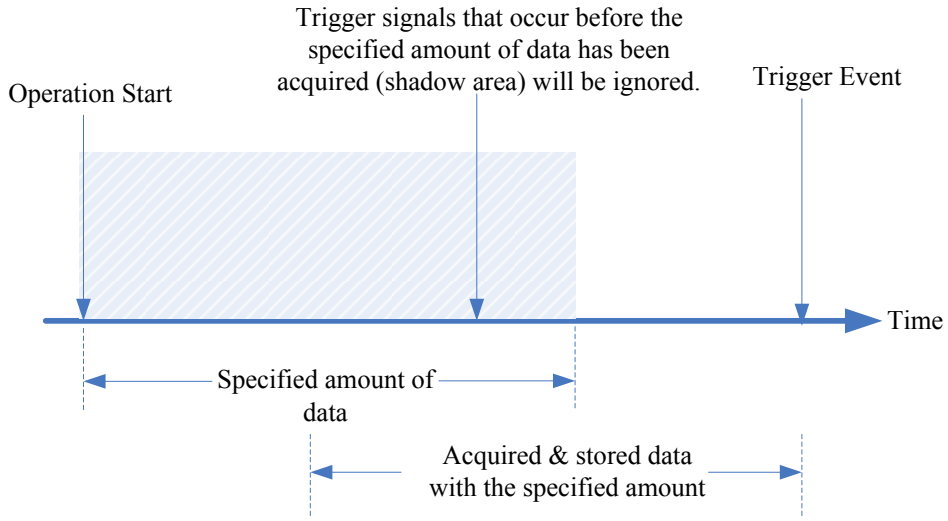

Trigger signals that occur before the specified amount of data has been acquired (shadow area) will be ignored.
Operation Start
Trigger Event
Time
Specified amount of data
Acquired & stored data with the specified amount

Figure 4.9 Pre Trigger (the trigger signal will be ignored until the specified amount of data is acquired)

4.3.3 Middle-trigger Acquisition

Use middle-trigger acquisition when you want to collect data before and after the trigger event. The amount of stored data before and after the trigger can be set individually (M and N), as illustrated in Figure 4.10.

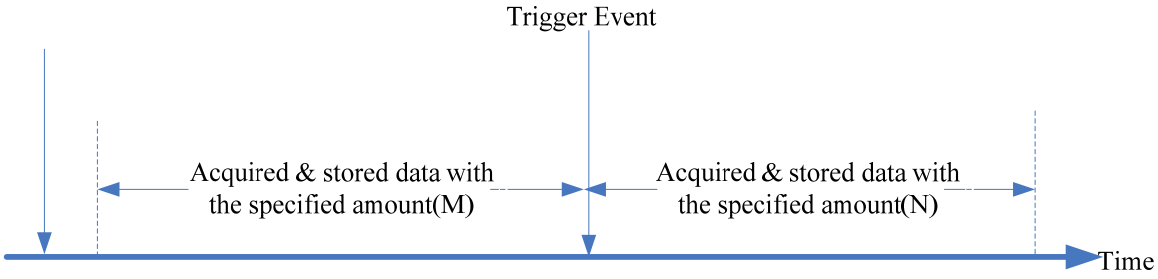


Figure 4.10 Middle Trigger

Like pre-trigger mode, the stored data may be less than the amount specified if the trigger event occurs before the specified amount of data (M) has been acquired. Users can also set by program to ignore trigger signals until the specified amount of data (M) has been acquired.

4.3.4 Delay-trigger Acquisition

Use delay trigger acquisition to delay the data collection after the trigger event, as illustrated in Figure 4.11. If the trigger event starts, it will delay (M), then starts to acquire the data with the specified amount (N).

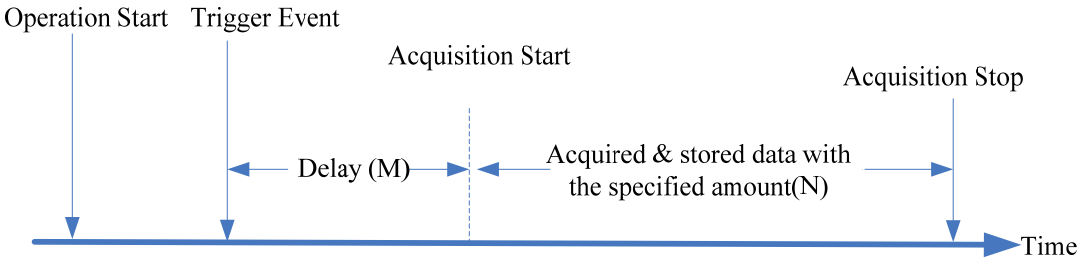


Figure 4.11Delay Trigger

Chapter 5 Methods of using AD Internal and External Clock Function

5.1 Internal Clock Function of AD

Internal Clock Function refers to the use of on-board clock oscillator and the clock signals which are produced by the user-specified frequency to trigger the AD conversion regularly. To use the clock function, the hardware parameters ADPara.ClockSource = PXI8501 _CLOCKSRC_IN should be installed in the software. The frequency of the clock in the software depends on the hardware parameters ADPara.Frequency. For example, if Frequency = 100000, that means AD work frequency is 100000Hz (that is, 100 KHz, 10 us/point).

5.2 External Clock Function of AD

External Clock Function refers to the use of the outside clock signals to trigger the AD conversion regularly. The clock signals are provide by the CLKIN pin of the CN1 connector. The outside clock can be provided by clock frequency generators and so on. To use the external clock function, the hardware parameters ADPara.ClockSource = PXI8501_CLOCKSRC_OUT should be set in the software. The clock frequency depends on the frequency of the external clock, and the clock frequency on-board is invalid, the sampling frequency of the AD is fully controlled by the external clock frequency.

Chapter 6 Notes, Calibration and Warranty Policy

6.1 Notes

In our products' packing, user can find a user manual, a PXI8501 module and a quality guarantee card. Users must keep quality guarantee card carefully, if the products have some problems and need repairing, please send products together with quality guarantee card to ART, we will provide good after-sale service and solve the problem as quickly as we can.

When using PXI8501, in order to prevent the IC (chip) from electrostatic harm, please do not touch IC (chip) in the front panel of PXI8501 module.

6.2 Auto-calibration

By using the auto-calibration feature of the PXI8501, the calibration software can measure and correct almost all the calibration errors without any external signal connections, reference voltages, or measurement de-vices.

NOTE:

1. Before auto-calibration procedure starts, it is recommended to warn up the card for at least 15 minutes.
2. Please remove the cable before an auto-calibration procedure is initiated because the calibration factor outputs would be changed in the process of the calibration.

6.3 Saving Calibration Constants

After an auto-calibration is completed, users can save the new calibration constants into one of the three user-modifiable banks in the EEPROM.

6.4 Warranty Policy

Thank you for choosing ART. To understand your rights and enjoy all the after-sales services we offer, please read the following carefully.

1. Before using ART's products please read the user manual and follow the instructions exactly. When sending in damaged products for repair, please attach an RMA application form which can be downloaded from: www.art-control.com.

2. All ART products come with a limited two-year warranty:

- The warranty period starts on the day the product is shipped from ART's factory
- For products containing storage devices (hard drives, flash cards, etc.), please back up your data before sending them for repair. ART is not responsible for any loss of data.
- Please ensure the use of properly licensed software with our systems. ART does not condone the use of pirated software and will not service systems using such software. ART will not be held legally responsible for products shipped with unlicensed software installed by the user.

3. Our repair service is not covered by ART's guarantee in the following situations:
- Damage caused by not following instructions in the User's Manual.
- Damage caused by carelessness on the user's part during product transportation.
- Damage caused by unsuitable storage environments (i.e. high temperatures, high humidity, or volatile chemicals).
- Damage from improper repair by unauthorized ART technicians.
- Products with altered and/or damaged serial numbers are not entitled to our service.

4. Customers are responsible for shipping costs to transport damaged products to our company or sales office.
5. To ensure the speed and quality of product repair, please download an RMA application form from our company website.

Products Rapid Installation and Self-check

Rapid Installation

Product-driven procedure is the operating system adaptive installation mode. After inserting the disc, you can select the appropriate board type on the pop-up interface, click the button【driver installation】; or select CD-ROM drive in Resource Explorer, locate the product catalog and enter into the APP folder, and implement Setup.exe file. After the installation, pop-up CD-ROM, shut off your computer, insert the PCI card. If it is a USB product, it can be directly inserted into the device. When the system prompts that it finds a new hardware, you do not specify a drive path, the operating system can automatically look up it from the system directory, and then you can complete the installation.

Self-check

At this moment, there should be installation information of the installed device in the Device Manager (when the device does not work, you can check this item.). Open "Start -> Programs -> ART Demonstration Monitoring and Control System -> Corresponding Board -> Advanced Testing Presentation System", the program is a standard testing procedure. Based on the specification of Pin definition, connect the signal acquisition data and test whether AD is normal or not. Connect the input pins to the corresponding output pins and use the testing procedure to test whether the switch is normal or not.

Delete Wrong Installation

When you select the wrong drive, or viruses lead to driver error, you can carry out the following operations: In Resource Explorer, open CD-ROM drive, run Others-> SUPPORT-> PCI.bat procedures, and delete the hardware information that relevant to our boards, and then carry out the process of section I all over again, we can complete the new installation.